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Air Force Materiel Command
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Barrier Islands

Introduction

Eglin Air Force Base is the largest air force base in the free world, including 724 square miles of land area and about 130,000 square miles of controlled airspace overlying land and water. In this setting, Eglin conducts its primary mission of full-service air armament development through weapons system research, development, testing and evaluation; training; space operations; and base and range support. While fulfilling its mission, Eglin also manages its natural resources, acting as a steward to protect plants and animals for future generations.

Eglin's coastal barrier lands are located on Santa Rosa Island and at Cape San Blas*. The significance of these Eglin tracts is highlighted by the rapid spread of urban expansion beyond Eglin's boundaries. Beach front property is being rapidly developed for tourism, commercial and residential purposes. As more coastline is developed, Eglin's barrier islands will become increasingly significant for preserving the natural heritage of Florida's Gulf coast.

Barrier Islands

Barrier islands in the Eglin area are long, narrow accumulations of sediment—sand or gravel—that have formed in the shallow coastal zone and are separated from the mainland by some combination of coastal bays or lagoons and marshes. They are typically separated from each other by a tidal inlet, a channel of water. These islands protect the mainland from the ocean's energies and are constantly being changed by natural forces. While they occur throughout the world, the most extensive system of barrier islands lies along the Atlantic and Gulf coasts of the United States.

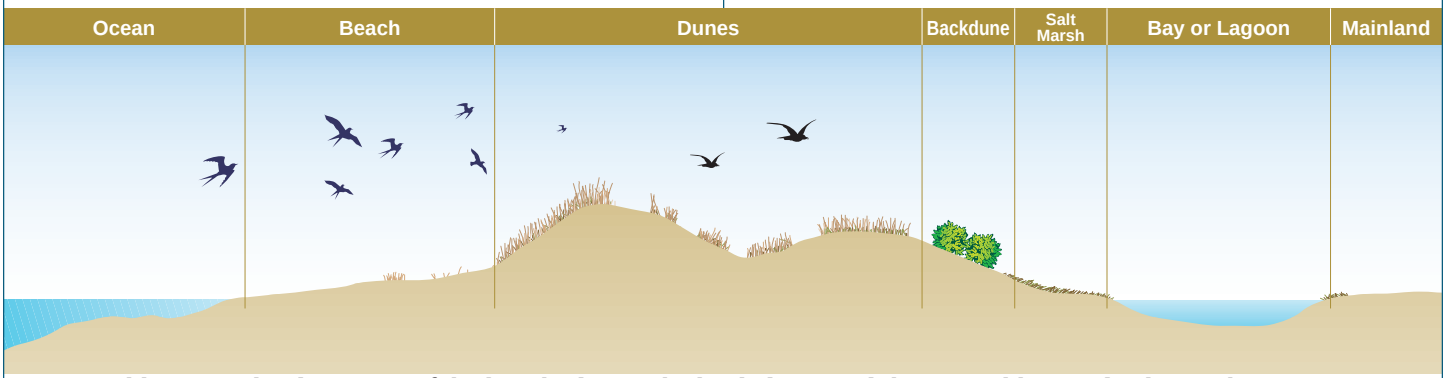
Formation of Barrier Islands

Over the years, scientists have developed various theories to explain how barrier islands formed. The presently accepted theory is that sediments carried by the rising sea level, along with submersion of beach ridges and headlands, made the first barrier islands. The ridges and headlands were eroded by wave action, forming spits or bars and lengthening the spits or bars. The spits or bars protected the lagoon behind them, allowing marshes to form. During storms or periods of high water, inlets formed, which provided nutrients and sediments for the new marshes.

Processes Affecting Barrier Islands

Every barrier island is unique, but the processes that affect and constantly change them are the same: waves, tides, currents, winds, sea level changes and storms.

- Waves—Waves usually break at an angle to the beach, an action that generates currents. Crashing waves may also cause temporary suspension of sediments, which can then be carried along the beach by currents. Waves are most active on the ocean side of the island but also occur on the bay side.
- Currents—Currents flow away from the angle where waves break and carry sediments along the beach. Strong currents, known as rip currents, run away from the beach back to the ocean and may also carry sediments out to sea. Tidal currents may carry large amounts of sediments through inlets and deposit them in the lagoon or marshes.
- Tides—Tides generate currents that move sediments. They may also flood low areas and deposit sediments in marshes or tidal flats.



A typical barrier island consists of the beach, dunes, the back dune, and the coastal bay and salt marsh.

* *Technically, because it is attached to the mainland, Cape San Blas is a barrier spit rather than a barrier island. The forces that form and affect barrier spits and barrier islands are the same.*

Eglin?s coastal barrier lands include three narrow tracts in Santa Rosa, Okaloosa, and Gulf counties. The western tract is 13 miles long, and the central tract is 4 miles long. The eastern tract, known as Cape San Blas, is about 500 acres, with 3 miles of beach front.

- Winds—Wind energy far out to sea generates most waves. Onshore winds blow sediments from the beach, helping to form dunes. Winds carry sediments from dunes to marshes or bays.
- Sea Level Changes—Some scientists believe that change in sea level has the most important long-term effect on barrier islands. A continuing rise in sea level is the major reason that barrier islands move towards the mainland as time passes. During the past 50 years, sea levels have risen worldwide at an accelerating rate, believed to be partly due to the *greenhouse effect*. This term applies to the trapping of solar energy by water vapor, carbon dioxide (CO^2), and other naturally occurring gases that determine our climate. The burning of fossil fuels, cutting of forests, and other human activities are trapping more heat in the Earth?s atmosphere. One result is an increased melting of glaciers and the polar ice caps, thus contributing to rising sea levels.
- Storms—The most dramatic changes in barrier islands are caused by storms, particularly hurricanes on the Gulf coast. The size, intensity, and speed of a storm, the tidal phase, and the storm?s path influence overall impacts. Severe erosion is more likely to occur if there are two or more high tide cycles during the storm. *Storm surge*, an above-normal water level that results from low atmospheric pressure and high winds, can be especially damaging. Storms may also move sediments to the back dune by breaking through or over primary dunes. Generally, a storm flattens the beach and builds sandbars offshore. Natural forces usually rebuild the beach over time as wave action eventually pushes the sand ashore. This may take years. However, a rebuilt beach is not identical to the beach that existed before the storm.

The shape and position of the beach depends on waves, sediment/sand supply, and sea level changes. The natural balance of these three factors is called *dynamic equilibrium.* When one factor changes, the others adjust to maintain the natural balance.

Dune Building and Vegetation

Sand dunes are mounds or ridges of beach sand deposited by wind. Their shape is determined by the amount of sand available and the prevailing wind direction. Dunes occur when dry sand begins to build at some obstacle, such as plant debris or a shell. If a plant grows on the mound that results, the mound will begin to grow larger. As it blows around vegetation, the wind?s speed is reduced, causing sand grains to drop. Plant roots help to stabilize the sand.

Few plant species are able to thrive in the harsh beach or dune environment. To survive, they must be able to tolerate salt spray, extreme heat, drought, sand blasting and burial, and low nutrient supply. Sea oats (*Uniola paniculata*) and bitter panicum (*Panicum amarum*) are two species that do well in this environment along the Gulf coast.

Importance of Dune Protection

Dunes are extremely important as barriers to waves or storm surges. They also can serve as a source of sand or sediment for rebuilding the beach and protect low areas behind them.

Even minor damage to the dune or dune vegetation can make the dune less stable. Once sand is free to move again, established plants may be covered with sand. Most dune plants cannot survive being covered by sand. If a plant dies, the stabilizing effect of the plant is lost. The dune may begin to disintegrate and may eventually return to its original unstable form. Water washing over the dune, storm surges, grazing and drought can also destroy vegetation and speed up erosion.

People are asked to stay off the dunes. Protection from foot and vehicle traffic cannot be overemphasized. Many studies have shown that dune grasses cannot tolerate trampling by foot or vehicle traffic. Driving off-road vehicles on dunes not only damages grasses but can even alter the dune profile. Foot traffic can be equally damaging. Visitors generally take the shortest and easiest path to the beach, often following existing trails over dunes. This foot traffic destroys plants. These trails in the dunes serve as paths storm waters surge through, allowing salt-water flooding of interior environments.

Santa Rosa Island

Santa Rosa Island hosts five different communities of vegetation: beach dunes; coastal grasslands; low-lying, usually wet areas called *swales*; habitat requiring moderate amounts or moisture (*mesic flatwoods*); and scrub (areas containing stunted trees or shrubs). All are in relatively pristine condition. During 1995, the island received extensive damage as a result of Hurricanes Erin and Opal. For example, dunes were 60-100 feet in some areas, and now they are gone. A brief study of the effects of these storms found that the beach dune, swales, and scrub vegetation were most damaged. Nevertheless, hurricane disturbance is a natural part of barrier island ecology. Although these areas have been altered, Eglin?s barrier islands will continue to be some of the most pristine, ecologically significant coastal communities in Florida.

This fact sheet is one in a series designed to inform the public about ecosystem and resource management activities at Eglin Air Force Base.
For more information, contact Environmental Public Affairs Coordinator, AFDTC/PAV, (904) 882-4436, Ext. 333.
This fact sheet is also available on the World Wide Web via the Eglin Homepage at http://www.eglin.af.mil

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